



From Arctic greenhouse to icehouse: the Cenozoic development of the West Greenland-Baffin Bay margin and the case for scientific drilling

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The long-term evolution of glaciated margins plays an essential role in understanding the driving forces and interactions that determine the build-up and decay of ice sheets. The Greenland continental margin towards Baffin Bay is densely covered by industry seismic data and several exploration wells have been drilled, providing a regional stratigraphic framework for the sedimentary successions. This presentation provides an overview of the major depositional units and stratigraphy of the mid-late Cenozoic (since mid-Eocene), with examples demonstrating the different processes that have formed this margin. A sedimentary succession up to 3.5 km thick, of mid-Eocene to mid-Miocene age (mega-unit D), infills the pronounced ridge-basin structures of the rifted and tectonically inverted margin. The lower part of this interval, presumably late Eocene-Oligocene in age, is interpreted as basin-floor fan deposits, while the upper section, of early-middle Miocene age, is mainly marine mudstone. The basin infilling strata are overlain by a late Miocene-Pliocene succession consisting of two mega-units (B and C), with typical thicknesses of 0.5-1 km. The units are characterised by upslope-climbing sediment waves and along-slope trending sedimentary prisms reminiscent of giant contourite drifts. The borehole data associates the prism accumulations with a deep shelf environment influenced by strong marine currents and nearby fluvial sources. On the slope and in the deep basin of Baffin Bay the late Neogene succession is strongly influenced by mass wasting correlated with erosional scars updip. The uppermost seismic mega-unit (A) is dominated by aggradational wedges and prograding fan deposits displaying depocentres >3 km thick, formed at the terminus of palaeo-ice streams. Borehole information associates this interval with deposition of primarily diamict sediments and suggests a late Pliocene onset of major shelf based glaciations on the NW Greenland margin.

The southwest margin of Baffin Bay was drilled in 1985 during ODP leg 105 (site 645) and remains the only cored section of the upper Cenozoic in the region. Scientific drilling of the sedimentary units on the NW Greenland margin would provide new insights into the climatic evolution of the Arctic region and, specifically, the factors that influence the growth and variability of the Greenland Ice Sheet. In favour of an IODP drilling campaign is the near-seabed position of the slightly dipping Neogene strata (a result of ice-scouring and tectonics), meaning that an overlapping stratigraphy could be achieved by drilling to limited depths, e.g. 200-400 m.